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SIR JOSEPH HOOKER[1]

With the passage of time the importance attached to persons and events becomes strangely altered. History, to be of value to posterity, must be both more and less than a faithful chronicle of the past. Less, if only to bring it within intelligible limits; more, because it must see causes in relation to effects, emphasizing the inconspicuous beginnings of new developments. For such reasons, the judgment of posterity will nearly always differ from that of contemporaries; not necessarily because posterity is endowed with superior wisdom, but rather because the basis of judgment is different. Sir Joseph Hooker and his father, Sir William Hooker (1785–1865), were both botanists of the highest eminence, their combined activities covering more than a century. As we review their careers, we do not know which to admire most. The son, without the slightest false modesty, always insisted on his father's preeminence, giving good reasons for his judgment. It was William Hooker who, with extraordinary energy and enthusiasm, had created great botanical centers, first at Glasgow, and then for the whole British Empire at Kew. When the work was most difficult and recognition hardest to obtain, he had won support and respect; and had laid the foundations on which his son was to build. It is difficult for us, to-day, to realize the labor and vision required to build up the establishment at Kew, in the face of ignorance and opposition. It is difficult for posterity to do full justice to the elder Hooker, just because we can no longer clearly visualize the environment in which he lived. His work, everywhere woven into the fabric of modern botany, has few outstanding or picturesque features. In the case of Sir Joseph Hooker, the imagina-

[1] *Life and Letters of Sir Joseph Dalton Hooker.* By LEONARD HUXLEY. 2 vols. New York, D. Appleton & Co. 1918.

tion is more easily quickened. Aside from his great merits as a master of technical botany, he will always live in the pages of history as one of the group of men immediately associated with Darwin. The personalities of Darwin, Hooker, Huxley and Wallace stand out in the history of biological science in such a manner that they are never likely to be forgotton. On the contrary, because they will be taken as typical of a movement and a period, they will increase rather than diminish in the estimation of mankind. They will have the value of a moral force; veritable saints of science, patterns for all later generations. In strict equity, it may be that Hooker should not stand on so high a pedestal as we shall place him, but we are concerned rather with our needs than his deserts.

Under these circumstances, an authoritative and full account of the life of Sir Joseph Hooker becomes a necessity. This work, written by Leonard Huxley, and based on materials collected and arranged by Lady Hooker, has just been published in two volumes, and is the subject of this notice. It is the story of a long life of incessant activity; devoted to the classification and description of plants, the administration of a great botanical establishment, and to explorations in distant regions. In 1837 Hooker published the descriptions of three new mosses; in 1911 he published a number of new species of *Impatiens*. Such a record is surely unique. It seems strange to think that this man, whose living presence is still vividly in our mind, knew four of the founders of the Linnean Society, and talked with Humboldt. There is an amusing account of his first meeting with Humboldt in Paris:

> On putting up here I sent in my card with Mr. Brown's books to Baron Humboldt; he was not at home, but sent his flunkey (Scoticè Footman) to my bedroom at eight o'clock yesterday morning to say his master wished to see me at nine o'clock. Ten minutes after his Lord had grown impatient and sent to say he was all ready, so I went in and saw to my horror a *punchy little German*, instead of a Humboldt. There was no mistaking his head, however, which is exceedingly like all the portraits, though now powdered with white. I expected to see a fine fellow six feet without his boots, who would make as few steps to get up Chimborazo as thoughts to solve a problem. I can not now at all fancy his trotting along the Cordillera as I once supposed he would have *stalked*. However, he received me most kindly and made a great many enquiries about all at Kew and in England.

Later on, Hooker was able to emulate Humboldt in the exploration of mountains, but on the other side of the world—in the Himalayas. The story of his Indian work is well known, but is of perennial interest. He did much more than explore new regions and find new plants. India is indebted to him for much of her scientific development and material prosperity. When he went there, he found the government singularly apathetic as regards science. He went out with Lord Dalhousie, the governor-general, who took a fancy to him and treated him very kindly, but had no interest in botany. In a letter home he relates:

> I find Lord Dalhousie an extremely agreeable and intelligent man in everything but natural history and science of which he has a lamentably low opinion, I fear. He is a perfect specimen of the miserable system of education pursued at Oxford, and as ignorant of the origin and working of our most common manufacturing products and arts as he is well informed on all matters of finance, policy, etc. I very carefully drop a little knowledge into him now and then; but I can not awaken an interest or any sympathy in my pursuits: he is much pleased at my being busy, and especially with my carrying on my meteorological register three times a day. Lady Dalhousie shares her husband's apathy, but is otherwise a kind hearted creature. In the desert I brought them the gum arabic *Acacia*, which I thought must interest the late president of the board of trade; but he chucked it out of the carriage window: and the rose of Jericho, with an interest about it of a totally different character, met no better fate.

On his return from India and indeed while he was still there, he contemplated a "Flora Indica," to contain descriptions of all known Indian plants. In a letter to his father he wrote:

> It is easy to talk of a "Flora Indica," and Thomson and I do talk of it, to imbecility! But

suppose that we even adopted the size, quality of paper, brevity of description, etc., which characterized De Candolle's prodromus, and we should, even under these conditions, fill twelve such volumes, at least . . . about eighteen years' fair work would be needed.

He then asks, how is such an undertaking to be supported?—"neither our government nor the East India Company will give a sum in any way proportional to the work." But the idea was never given up, and in 1897, after an interval of about fifty years, Hooker saw the publication of the last volume of "The Flora of British India." This he regarded as only a beginning—a preliminary assembling of scattered materials—and during the last years of his life he incessantly urged Indian botanists to study the living plants, and revise every part of the "Flora.' His own work on the Balsaminaceæ, carried on after he was ninety years old, represented the beginning of such a revision.

To the last, Hooker retained his special interest in the people of India as well as its "Flora." Thus, in the year of the coronation of King Edward VII.:

As I was at the Waterloo Station yesterday, four Indian regiments filed past me—they sent the blood flying to my finger tips, such grand fellows, and such gentlemen, such proud yet pleasant faces, such an air of dignity and self-respect.

In the Himalayas, he did some geological work which later proved of more value than he had anticipated. But when he studied fossil plants, he did not consider that he was leaving his special botanical field. "I am no geologist: my work is fossil botany; as legitimately a branch of *Botany* as is muscology; fossil plants, though imperfect, are still *pure* plants; and, though dead as species, they form and show links between existing forms, upon which they throw a marvellous light." Later on, he came to be very skeptical about the value of much of the work of the paleobotanists, and in 1887 expressed himself thus:

It is an ugly fact that, tempting as is the study of fossil botany, every competent botanist with a large knowledge of existing floras, and that has tried his hand on it, has given it up, notably Brown, Brongniart and Lindley, or these have subsequently confined themselves to specimens exhibiting *structure*, as fossil wood, etc.—whilst Oliver, Bentham, etc., have only shaken their heads when asked to identify a fossil plant. If you are ever at the Herbarium and will look at the multitudes of figures of leaves in Gardner, Lesquereux and other works, the vagueness of the identifications will strike you at once. There is a standing joke at the Herbarium [Kew], if you have a plant the affinities of which puzzle you, "fossilize it and send it to a paleontologist and he will give you the genus and species at once."

As materials accumulated at Kew, and Hooker found before him long series of specimens from numerous localities, he recognized many intermediates between supposedly distinct species. Thus he was led to make great allowances for variation, becoming what is sometimes called a "lumper." Darwin called his attention to the probability that many of the observed intermediates might actually be hybrids, and in a characteristic letter he replied:

The dismal fact that you quote of hybrid transitions between *Verbascum thapsus* and *nigrum* (or whichever two it was) and its bearing on my practise of lumping species through intermediate specimens, is a very horrible one; and would open my eyes to my own blindness if nothing else could. I have long been prepared for such a case, though I once wrote much against its probability. I feel tolerably sure I must have encountered many such, but have not had the tact to discern them, when under my nose, and hence I feel as if all my vast experience in the field has been thrown away.

It seems almost unbelievable to-day, that after Hooker's splendid work on the Antarctic floras and Indian explorations, he should have been so hard put to find a means of living by botany, that he was advised to abandon the subject. He was told that there was a vacancy in the mineralogical department at the British Museum, and,

To be sure I know nothing of crystallography, mineralogy, chemistry, etc., but the trustees are above such prejudice against a man who could wear a white neckcloth with ease, and take his fair share of their abuses with equanimity, which would be an all-powerful testimonial. I hate the idea

of giving up botany, but I am advised to try for it by Gray particularly and my father proposes it.

A few years later (1854) he said:

I sometimes think seriously of giving up Kew and living in London and writing for the press.

But it could not be, and when his friend Bentham had similar doubts, he wrote:

If I thought you would be a happier man I would advise you to give up botany; but you would not be so, and evil as our days are, whether they mended or worsed, it would be all the worse to you to have given up what is at least a wholesome and constant mental resource. I sometimes despond too, but as I was once told, "I am limed to the twig." and so are you!

The names of Bentham and Hooker, authors of the "Genera Plantarum," will always remain united in scientific literature. The personal association of the two men was all that could be desired; a result of their common interests and high character. Hooker writing to the botanist Harvey in 1856, takes occasion to say:

Bentham's unselfish love of science always charms me, he has never a thought of personal aggrandizement in money or honor; but indeed we have both of us lived under the highest examples and happiest influences in these respects. My father, Bentham and Thomson are such a trio as we shall never see again. Except Faraday and Darwin I know of no others in the walks of science so pure and disinterested, except perhaps Asa Gray in America.

In 1860 Hooker settled down to the work on "Genera Plantarum," and wrote to Huxley:

We are not likely to meet except at the Linnean, for I have inaugurated a new era in my life, and am going to take the world and all that is therein as coolly as I can. When perfect myself I shall commence operating on you. What is the use of tearing your life to pieces before you are fifty? which you are (and I was) doing as fast as possible.

Huxley's reply is so good, and so pertinent just now, that it must be cited at length:

And finally as to your resolutions, my holy pilgrim, they will be kept about as long as the resolutions of anchorites who are thrown into the busy world. Or, I won't say that, for assuredly you will take the work "as coolly as you can"—and so shall I. But that coolness amounts to the red heat of properly constructed mortals.

It is no use having any false modesty about the matter. You and I, if we last ten years longer—and you by a long while first—will be the representatives of our respective lines in the country. In that capacity we shall have certain duties to perform, to ourselves, to the outside world, and to science. We shall have to swallow praise, which is no great pleasure, and to stand multitudinous bastings and irritations, which will involve a good deal of unquestionable pain. Don't flatter yourself that there is any moral chloroform by which either you or I can render ourselves insensible or acquire the habit of doing things coolly.

It is assuredly of no great use to tear one's life to pieces before one is fifty. But the alternative for men constituted on the high pressure tubular boiler principle like ourselves, is to lie still and let the devil have his own way. And I will be torn to pieces before I am forty sooner than see that.

Hooker's correspondence with Harvey brings out some of his general ideas in an interesting way. He observes how the habit of precision grows until it becomes in a sense detrimental to progress:

The besetting sin of the botanists of the day is the *craving for perfect materials;* forgetful that these sciences are all progressive, and our efforts but steps in the progression. . . . I would urge you to think now of putting together some of your ideas and facts on wider branches than purely descriptive. I think that this becomes a duty after a certain time of life with those who keep such subjects before them—too much of our dear bought experience dies with us, and the pursuit of careful descriptive botany rather renders us too timid about striking out into generalities that are the product of years of insensibly gained ideas.

It is unnecessary to recount here Hooker's part in relation to the publication of Darwin's theory, or in connection with the spread of evolutionary ideas, but there is a little bit of personal history which is as interesting as it is amusing. We have all heard of the famous debate on evolution at the meeting of the British Association, when the Bishop of Oxford and Huxley crossed swords before an excited audience. It has not been generally understood that Hooker had a conspicuous

part in this affair, and his own account of it, written at the time in a letter to Darwin, is as follows:

Well, Sam Oxon got up and spouted for half an hour with inimitable spirit, ugliness and emptiness and unfairness. I saw he was coached up by Owen and knew nothing, and he said not a syllable but what was in the Reviews; he ridiculed you badly and Huxley savagely. Huxley answered admirably and turned the tables, but he could not throw his voice over so large an assembly, nor command the audience; and he did not allude to *Sam's* weak points nor put the matter in a form or way that carried the audience. The battle waxed hot, Lady Brewster fainted, the excitement increased as others spoke; my blood boiled, I felt myself a dastard; now I saw my advantage; I swore to myself that I would smite that Amalekite, Sam, hip and thigh if my heart jumped out of my mouth, and I handed my name up to the president (Henslow) as ready to throw down the gauntlet.

I must tell you that Henslow as president would have none speak but those who had arguments to use, and four persons had been bunked by the audience and president for mere declamation: it moreover became necessary for each speaker to mount the platform, and so there I was cocked up with Sam at my right elbow, and there and then I smashed him amid rounds of applause. I hit him in the wind at the first shot in ten words taken from his own ugly mouth; and then proceeded to demonstrate in as few more: (1) that he could never have read your book, and (2) that he was absolutely ignorant of the rudiments of Botanical Science. I said a few more on the subject of my own experience and conversion, and wound up with a very few observations on the relative positions of the old and new hypotheses, and with some words of caution to the audience. Sam was shut up—had not one word to say in reply, and the meeting *was dissolved forthwith*, leaving you master of the field after four hours' battle. Huxley, who had borne all the previous brunt of the battle, and who never before (thank God) praised me to my face, told me it was splendid, and that he did not know before what stuff I was made of. I have been congratulated and thanked by the blackest coats and whitest stocks in Oxford.

Henslow, best remembered as the teacher and friend of Darwin at Cambridge, was Hooker's father-in-law. The latter's respect and affection for him were unbounded. He writes to Huxley from Henslow's deathbed:

I am utterly overwhelmed; to be loved as he was for the good he had done I would lay down my science and almost turn parson. To me personally the loss will be inmeasurable—he took interest in everything I did and I loved him—I am wrong to think how much. His loss to this neighborhood will be incalculable; there is none to take his place morally, socially or religiously.

Hooker's attitude toward Darwin was that of a disciple. Although Darwin always looked up to Hooker as his master and guide in all matters botanical, the latter could unaffectedly write in this delightful strain:

The whole thing [*i. e.*, Hooker's masterly work on Welwitschia] is, however, a dry record of singular structures, and sinks down to the level of the dullest descriptive account of dead matter beside your jolly dancing facts anent orchid-life and bee-life. I have looked at an Orchid or two since reading the Orchid book, and feel that I never could have made out one of your points, even had I limitless leisure, zeal and material. I am a dull dog, a very dull dog. I may content myself with the *per contra* reflection that you could not (be dull enough to) write a "Genera Plantarum," which is just about what I am best fitted for. I feel I have a call that way and you the other.

In his early days, Hooker took an interest in entomology; and he recurs more than once to the relationship between insects and plants as having an important bearing on the larger problems of botany. Since he had no time for entomology, it is regrettable that he did not have a group of entomological friends to work on the problems he so often had in mind. The bees of high altitudes in the Himalayas, noticed by Hooker, were first studied and described from the collections of the Thibet Mission, fifty-five years later. Darwin's orchid book suggested to him:

That insects may have a wonderful deal more to do with checking migration than climate or geographics, and that the absence of whole genera may thus one day be accounted for by absence of genera of insects: in short the cat and clover story is capable of immediate expansion by any one having sufficient knowledge of plants, insects and geography.

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SCIENCE

FRIDAY, JUNE 6, 1919

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SIR JOSEPH HOOKER[1]

With the passage of time the importance attached to persons and events becomes strangely altered. History, to be of value to posterity, must be both more and less than a faithful chronicle of the past. Less, if only to bring it within intelligible limits; more, because it must see causes in relation to effects, emphasizing the inconspicuous beginnings of new developments. For such reasons, the judgment of posterity will nearly always differ from that of contemporaries; not necessarily because posterity is endowed with superior wisdom, but rather because the basis of judgment is different. Sir Joseph Hooker and his father, Sir William Hooker (1785–1865), were both botanists of the highest eminence, their combined activities covering more than a century. As we review their careers, we do not know which to admire most. The son, without the slightest false modesty, always insisted on his father's preeminence, giving good reasons for his judgment. It was William Hooker who, with extraordinary energy and enthusiasm, had created great botanical centers, first at Glasgow, and then for the whole British Empire at Kew. When the work was most difficult and recognition hardest to obtain, he had won support and respect; and had laid the foundations on which his son was to build. It is difficult for us, to-day, to realize the labor and vision required to build up the establishment at Kew, in the face of ignorance and opposition. It is difficult for posterity to do full justice to the elder Hooker, just because we can no longer clearly visualize the environment in which he lived. His work, everywhere woven into the fabric of modern botany, has few outstanding or picturesque features. In the case of Sir Joseph Hooker, the imagina-

[1] *Life and Letters of Sir Joseph Dalton Hooker.* By LEONARD HUXLEY. 2 vols. New York, D. Appleton & Co. 1918.

tion is more easily quickened. Aside from his great merits as a master of technical botany, he will always live in the pages of history as one of the group of men immediately associated with Darwin. The personalities of Darwin, Hooker, Huxley and Wallace stand out in the history of biological science in such a manner that they are never likely to be forgotton. On the contrary, because they will be taken as typical of a movement and a period, they will increase rather than diminish in the estimation of mankind. They will have the value of a moral force; veritable saints of science, patterns for all later generations. In strict equity, it may be that Hooker should not stand on so high a pedestal as we shall place him, but we are concerned rather with our needs than his deserts.

Under these circumstances, an authoritative and full account of the life of Sir Joseph Hooker becomes a necessity. This work, written by Leonard Huxley, and based on materials collected and arranged by Lady Hooker, has just been published in two volumes, and is the subject of this notice. It is the story of a long life of incessant activity; devoted to the classification and description of plants, the administration of a great botanical establishment, and to explorations in distant regions. In 1837 Hooker published the descriptions of three new mosses; in 1911 he published a number of new species of *Impatiens*. Such a record is surely unique. It seems strange to think that this man, whose living presence is still vividly in our mind, knew four of the founders of the Linnean Society, and talked with Humboldt. There is an amusing account of his first meeting with Humboldt in Paris:

> On putting up here I sent in my card with Mr. Brown's books to Baron Humboldt; he was not at home, but sent his flunkey (Scotice Footman) to my bedroom at eight o'clock yesterday morning to say his master wished to see me at nine o'clock. Ten minutes after his Lord had grown impatient and sent to say he was all ready, so I went in and saw to my horror a *punchy little German*, instead of a Humboldt. There was no mistaking his head, however, which is exceedingly like all the portraits, though now powdered with white. I expected to see a fine fellow six feet without his boots, who would make as few steps to get up Chimborazo as thoughts to solve a problem. I can not now at all fancy his trotting along the Cordillera as I once supposed he would have *stalked*. However, he received me most kindly and made a great many enquiries about all at Kew and in England.

Later on, Hooker was able to emulate Humboldt in the exploration of mountains, but on the other side of the world—in the Himalayas. The story of his Indian work is well known, but is of perennial interest. He did much more than explore new regions and find new plants. India is indebted to him for much of her scientific development and material prosperity. When he went there, he found the government singularly apathetic as regards science. He went out with Lord Dalhousie, the governor-general, who took a fancy to him and treated him very kindly, but had no interest in botany. In a letter home he relates:

> I find Lord Dalhousie an extremely agreeable and intelligent man in everything but natural history and science of which he has a lamentably low opinion, I fear. He is a perfect specimen of the miserable system of education pursued at Oxford, and as ignorant of the origin and working of our most common manufacturing products and arts as he is well informed on all matters of finance, policy, etc. I very carefully drop a little knowledge into him now and then; but I can not awaken an interest or any sympathy in my pursuits: he is much pleased at my being busy, and especially with my carrying on my meteorological register three times a day. Lady Dalhousie shares her husband's apathy, but is otherwise a kind hearted creature. In the desert I brought them the gum arabic *Acacia*, which I thought must interest the late president of the board of trade; but he chucked it out of the carriage window: and the rose of Jericho, with an interest about it of a totally different character, met no better fate.

On his return from India and indeed while he was still there, he contemplated a "Flora Indica," to contain descriptions of all known Indian plants. In a letter to his father he wrote:

> It is easy to talk of a "Flora Indica," and Thomson and I do talk of it, to imbecility! But

suppose that we even adopted the size, quality of paper, brevity of description, etc., which characterized De Candolle's prodromus, and we should, even under these conditions, fill twelve such volumes, at least . . . about eighteen years' fair work would be needed.

He then asks, how is such an undertaking to be supported?—"neither our government nor the East India Company will give a sum in any way proportional to the work." But the idea was never given up, and in 1897, after an interval of about fifty years, Hooker saw the publication of the last volume of "The Flora of British India." This he regarded as only a beginning—a preliminary assembling of scattered materials—and during the last years of his life he incessantly urged Indian botanists to study the living plants, and revise every part of the "Flora.' His own work on the Balsaminaceæ, carried on after he was ninety years old, represented the beginning of such a revision.

To the last, Hooker retained his special interest in the people of India as well as its "Flora." Thus, in the year of the coronation of King Edward VII.:

> As I was at the Waterloo Station yesterday, four Indian regiments filed past me—they sent the blood flying to my finger tips, such grand fellows, and such gentlemen, such proud yet pleasant faces, such an air of dignity and self-respect.

In the Himalayas, he did some geological work which later proved of more value than he had anticipated. But when he studied fossil plants, he did not consider that he was leaving his special botanical field. "I am no geologist: my work is fossil botany; as legitimately a branch of *Botany* as is muscology; fossil plants, though imperfect, are still *pure* plants; and, though dead as species, they form and show links between existing forms, upon which they throw a marvellous light." Later on, he came to be very skeptical about the value of much of the work of the paleobotanists, and in 1887 expressed himself thus:

> It is an ugly fact that, tempting as is the study of fossil botany, every competent botanist with a large knowledge of existing floras, and that has tried his hand on it, has given it up, notably Brown, Brongniart and Lindley, or these have subsequently confined themselves to specimens exhibiting *structure*, as fossil wood, etc.—whilst Oliver, Bentham, etc., have only shaken their heads when asked to identify a fossil plant. If you are ever at the Herbarium and will look at the multitudes of figures of leaves in Gardner, Lesquereux and other works, the vagueness of the identifications will strike you at once. There is a standing joke at the Herbarium [Kew], if you have a plant the affinities of which puzzle you, "fossilize it and send it to a paleontologist and he will give you the genus and species at once."

As materials accumulated at Kew, and Hooker found before him long series of specimens from numerous localities, he recognized many intermediates between supposedly distinct species. Thus he was led to make great allowances for variation, becoming what is sometimes called a "lumper." Darwin called his attention to the probability that many of the observed intermediates might actually be hybrids, and in a characteristic letter he replied:

> The dismal fact that you quote of hybrid transitions between *Verbascum thapsus* and *nigrum* (or whichever two it was) and its bearing on my practise of lumping species through intermediate specimens, is a very horrible one; and would open my eyes to my own blindness if nothing else could. I have long been prepared for such a case, though I once wrote much against its probability. I feel tolerably sure I must have encountered many such, but have not had the tact to discern them, when under my nose, and hence I feel as if all my vast experience in the field has been thrown away.

It seems almost unbelievable to-day, that after Hooker's splendid work on the Antarctic floras and Indian explorations, he should have been so hard put to find a means of living by botany, that he was advised to abandon the subject. He was told that there was a vacancy in the mineralogical department at the British Museum, and,

> To be sure I know nothing of crystallography, mineralogy, chemistry, etc., but the trustees are above such prejudice against a man who could wear a white neckcloth with ease, and take his fair share of their abuses with equanimity, which would be an all-powerful testimonial. I hate the idea

of giving up botany, but I am advised to try for it by Gray particularly and my father proposes it.

A few years later (1854) he said:

I sometimes think seriously of giving up Kew and living in London and writing for the press.

But it could not be, and when his friend Bentham had similar doubts, he wrote:

If I thought you would be a happier man I would advise you to give up botany; but you would not be so, and evil as our days are, whether they mended or worsed, it would be all the worse to you to have given up what is at least a wholesome and constant mental resource. I sometimes despond too, but as I was once told, "I am limed to the twig." and so are you!

The names of Bentham and Hooker, authors of the "Genera Plantarum," will always remain united in scientific literature. The personal association of the two men was all that could be desired; a result of their common interests and high character. Hooker writing to the botanist Harvey in 1856, takes occasion to say:

Bentham's unselfish love of science always charms me, he has never a thought of personal aggrandizement in money or honor; but indeed we have both of us lived under the highest examples and happiest influences in these respects. My father, Bentham and Thomson are such a trio as we shall never see again. Except Faraday and Darwin I know of no others in the walks of science so pure and disinterested, except perhaps Asa Gray in America.

In 1860 Hooker settled down to the work on "Genera Plantarum," and wrote to Huxley:

We are not likely to meet except at the Linnean, for I have inaugurated a new era in my life, and am going to take the world and all that is therein as coolly as I can. When perfect myself I shall commence operating on you. What is the use of tearing your life to pieces before you are fifty? which you are (and I was) doing as fast as possible.

Huxley's reply is so good, and so pertinent just now, that it must be cited at length:

And finally as to your resolutions, my holy pilgrim, they will be kept about as long as the resolutions of anchorites who are thrown into the busy world. Or, I won't say that, for assuredly you will take the work "as coolly as you can"—and so shall I. But that coolness amounts to the red heat of properly constructed mortals.

It is no use having any false modesty about the matter. You and I, if we last ten years longer—and you by a long while first—will be the representatives of our respective lines in the country. In that capacity we shall have certain duties to perform, to ourselves, to the outside world, and to science. We shall have to swallow praise, which is no great pleasure, and to stand multitudinous bastings and irritations, which will involve a good deal of unquestionable pain. Don't flatter yourself that there is any moral chloroform by which either you or I can render ourselves insensible or acquire the habit of doing things coolly.

It is assuredly of no great use to tear one's life to pieces before one is fifty. But the alternative for men constituted on the high pressure tubular boiler principle like ourselves, is to lie still and let the devil have his own way. And I will be torn to pieces before I am forty sooner than see that.

Hooker's correspondence with Harvey brings out some of his general ideas in an interesting way. He observes how the habit of precision grows until it becomes in a sense detrimental to progress:

The besetting sin of the botanists of the day is the *craving for perfect materials;* forgetful that these sciences are all progressive, and our efforts but steps in the progression. . . . I would urge you to think now of putting together some of your ideas and facts on wider branches than purely descriptive. I think that this becomes a duty after a certain time of life with those who keep such subjects before them—too much of our dear bought experience dies with us, and the pursuit of careful descriptive botany rather renders us too timid about striking out into generalities that are the product of years of insensibly gained ideas.

It is unnecessary to recount here Hooker's part in relation to the publication of Darwin's theory, or in connection with the spread of evolutionary ideas, but there is a little bit of personal history which is as interesting as it is amusing. We have all heard of the famous debate on evolution at the meeting of the British Association, when the Bishop of Oxford and Huxley crossed swords before an excited audience. It has not been generally understood that Hooker had a conspicuous

part in this affair, and his own account of it, written at the time in a letter to Darwin, is as follows:

Well, Sam Oxon got up and spouted for half an hour with inimitable spirit, ugliness and emptiness and unfairness. I saw he was coached up by Owen and knew nothing, and he said not a syllable but what was in the Reviews; he ridiculed you badly and Huxley savagely. Huxley answered admirably and turned the tables, but he could not throw his voice over so large an assembly, nor command the audience; and he did not allude to *Sam's* weak points nor put the matter in a form or way that carried the audience. The battle waxed hot, Lady Brewster fainted, the excitement increased as others spoke; my blood boiled, I felt myself a dastard; now I saw my advantage; I swore to myself that I would smite that Amalekite, Sam, hip and thigh if my heart jumped out of my mouth, and I handed my name up to the president (Henslow) as ready to throw down the gauntlet.

I must tell you that Henslow as president would have none speak but those who had arguments to use, and four persons had been bunked by the audience and president for mere declamation: it moreover became necessary for each speaker to mount the platform, and so there I was cocked up with Sam at my right elbow, and there and then I smashed him amid rounds of applause. I hit him in the wind at the first shot in ten words taken from his own ugly mouth; and then proceeded to demonstrate in as few more: (1) that he could never have read your book, and (2) that he was absolutely ignorant of the rudiments of Botanical Science. I said a few more on the subject of my own experience and conversion, and wound up with a very few observations on the relative positions of the old and new hypotheses, and with some words of caution to the audience. Sam was shut up—had not one word to say in reply, and the meeting *was dissolved forthwith*, leaving you master of the field after four hours' battle. Huxley, who had borne all the previous brunt of the battle, and who never before (thank God) praised me to my face, told me it was splendid, and that he did not know before what stuff I was made of. I have been congratulated and thanked by the blackest coats and whitest stocks in Oxford.

Henslow, best remembered as the teacher and friend of Darwin at Cambridge, was Hooker's father-in-law. The latter's respect and affection for him were unbounded. He writes to Huxley from Henslow's deathbed:

I am utterly overwhelmed; to be loved as he was for the good he had done I would lay down my science and almost turn parson. To me personally the loss will be inmeasurable—he took interest in everything I did and I loved him—I am wrong to think how much. His loss to this neighborhood will be incalculable; there is none to take his place morally, socially or religiously.

Hooker's attitude toward Darwin was that of a disciple. Although Darwin always looked up to Hooker as his master and guide in all matters botanical, the latter could unaffectedly write in this delightful strain:

The whole thing [*i. e.*, Hooker's masterly work on Welwitschia] is, however, a dry record of singular structures, and sinks down to the level of the dullest descriptive account of dead matter beside your jolly dancing facts anent orchid-life and bee-life. I have looked at an Orchid or two since reading the Orchid book, and feel that I never could have made out one of your points, even had I limitless leisure, zeal and material. I am a dull dog, a very dull dog. I may content myself with the *per contra* reflection that you could not (be dull enough to) write a "Genera Plantarum," which is just about what I am best fitted for. I feel I have a call that way and you the other.

In his early days, Hooker took an interest in entomology; and he recurs more than once to the relationship between insects and plants as having an important bearing on the larger problems of botany. Since he had no time for entomology, it is regrettable that he did not have a group of entomological friends to work on the problems he so often had in mind. The bees of high altitudes in the Himalayas, noticed by Hooker, were first studied and described from the collections of the Thibet Mission, fifty-five years later. Darwin's orchid book suggested to him:

That insects may have a wonderful deal more to do with checking migration than climate or geographies, and that the absence of whole genera may thus one day be accounted for by absence of genera of insects: in short the cat and clover story is capable of immediate expansion by any one having sufficient knowledge of plants, insects and geography.

Also, as regards the past:

I quite believe in the sudden development of the mass of phanerogams being due to the introduction of flower-feeding insects.

While fully alive to the importance of laboratory researches, Hooker felt that nothing could take the place of a knowledge of the various kinds of plants in nature; and that after all, the whole was, in a sense, greater than its parts. In 1886 he writes to Asa Gray:

I am more and more absorbed in Indian botany, and have thrown aside all idea of making headway with—any desire to keep up with even—heads of chemico-botany, and microphytology. I may content myself with a casual grin at young men calling themselves botanists, who know nothing of plants, but the "innards" of a score or so. The pendulum will swing round, or rather back, one day.

In 1894 he recurs to the same subject, and writes to Francis Darwin:

I am glad you are going to teach the medicos a little practical botany. It is lamentable to find that all this botanical teaching of the greatest universities in England and Scotland does not turn out a single man who can turn his botanical knowledge to any use whatever to his fellow creatures. Where should we be if medicine, law or any other pursuit were taught after that fashion?

In his general ideas of education, he was "modern" in the sense of desiring practical vocational training; and in his indignation against the claims of the classicists. But he seems to have had little or no vision of an educated democracy, nor indeed of democracy in any form. He greatly admired certain characteristics of the Americans, writing to Asa Gray as early as 1854:

When you Yankees take up the higher branches of botany more generally you will turn out far more and better work than we do, for you are a far better educated, sounder, more practical people, and I look to you for the greatest discoveries, come when they may.

And in 1877, after traveling across the United States with Asa Gray, he wrote:

I had not the ghost of an adventure in America, where I saw a prodigious deal and learnt much. California was burnt up with nine months' drought, which obliterated the herbaceous vegetation and allowed me full time for the arboreous and fruticose. I was charmed with New England, disappointed with the Rocky Mountains as a range, and have no love for California, but all are full of great interest, and wonderful resources. Niagara did not disappoint me nor did the big trees. . . . The people I found to be wonderfully nice, and A. Gray is a trump in all senses.

The following, to W. E. Darwin in 1893, is singularly pertinent to-day:

I am dreamer enough to look for a time when America will forbid a European war! What a splendid rôle this would be for a nation to undertake—to send us all to our tents and tell us that we may snarl at one another in the length and breadth of Europe as much as we please, but nothing more, and that if we go further she will intervene.

Here we may leave this fascinating record of opinions and events, having quoted freely, but scarcely more than touched the treasures it contains. To have read it, following Hooker to the Antarctic, the Himalayas, the Atlas mountains and America; visiting him through it at Kew and at his home; all this is sufficient to stir the imagination and ambition of the most lethargic if he cares anything for science. The book should be in all public libraries; and it is permissible to hope that eventually a cheaper edition, perhaps somewhat abbreviated, may further widen the circle of its influence.

T. D. A. Cockerell
University of Colorado

A SUGGESTION FROM PLATO, WITH OTHERS

Students of human embryology, obstetricians and gynecologists are in daily need of terms to designate the various things included in an abortion. Many also realize the need for a more consistent use of such old words as embryonic and ovum. The word ovum constantly is used in contemporary medical literature to designate the unfertilized female sex cell; this cell when fertilized, the chorionic and amnionic vesicles with or without the contained embryo, and even the later product of conception. Under such circumstances confu-

sion is unavoidable and it certainly would seem advisable to restrict the term ovum to its comparative embryological significance. But this restriction leaves us without a designation for the whole product of conception. For this the word conceptus fortunately seems to be available. It is not new, and does not sound particularly well in the plural but we have other similar words in long established usage to which the latter objection applies. The term conceptus has the advantage of being applicable throughout the entire period of gestation.

It may seem that we should make use of the word conception, but a recent experience illustrates some of the difficulties which we are sure to encounter in adopting it. A proofreader for example, of a manuscript recently published, substituted the word conception for conceptus in a part of the manuscript. Because of delay in the mails and because of other things, an opportunity was not afforded to make the necessary changes before publication. Hence, in one sentence in which it was stated that a number of conceptuses were examined, it now is stated that so many conceptions were examined. The latter may imply: (1) that a given number of fertilizations were examined, (2) or that a certain number of individuals in the early months of pregnancy were examined, (3) or that abortuses were examined. Yet, none of these things was meant. None of the American medical or nonmedical dictionaries accessible to me here at Stanford University defined the word conception as referring to the thing conceived, except in the sense of mental conception. Murray, however, does recognize the use of the word in the sense of embryo or fetus, but since this usage is rare even in English medical literature and also foreign to us, it probably would be wiser not to try to revive an old meaning. Moreover, such a revival would not obviate the possibility of misunderstanding. Hence, an unequivocal term such as conceptus seems preferable.

At present the word embryo frequently is used to designate conceptuses in the earlier months of gestation. It is used still more frequently to designate merely the body of the developing individual during the early stages, in contrast to the word fetus, which is applied in the later months of pregnancy. Hence, we have need for still another term to be used in common for the embryonic disc, the embryo, or the fetus. My former colleague, Dr. Adolph Schultz, has kindly called my attention to the word kyema. I was happy to learn from my friend Professor Foster, that it is excellent Greek and was used in the proposed sense by no less than Plato[1] himself. It was used in this sense also by Æschylus.[2] Professor Foster, however, suggests, that we preferably spell the word cyema. This term of Plato's also has the advantage of being available for comparative embryology and of being adapted to meet such needs as are represented by the terms cyemetric and cyemology. At present, no one can know what is meant when one says that there are no embryonic remnants present. The addition of the word cyema would largely avoid this difficulty. It is not my purpose to suggest that the long established term embryology shall be abandoned or displaced, in spite of the fact that the derivative embryometrics is somewhat misleading. The same thing, to be sure, will remain true of the term embryology as long as we continue to use the term embryo in a restricted sense and in contrast to fetus. In these respects the derivatives of cyema would be preferable, it seems to me.

Although the word abortion is available to designate the individual thing or the material aborted, it has not been the custom to use it in this inclusive sense. As now used, the word invariably is restricted to apply to the act itself. To use it in a double sense would lead to some confusion. Since blood clot, pus, decidua and mucosa, usually not only are included with but frequently also surround the entire conceptus, one could use the word abortus to designate all the material expelled during abortion. It is only in this or a similar way that one can avoid the use of such misleading words as mole, and such expressions

[1] Rep. 461C.

[2] Aesch. Eum. 659.

as the entire mass, embryonic mass, abortion mass or quite inaccurately even the chorionic vesicle when the latter is surrounded by a certain amount of decidua and blood clot even!

I trust that readers will generously remember that I am aware that change may not imply immediate improvement or progress, but the absence of it surely never does. I realize full well that the use of unnecessary terms is to be avoided, but this is equally true of awkward circumlocution and misunderstanding. When anyone writes or says, at present, that no embryonic remnants were present or that he has seen an interesting abortion, it is impossible to know what he means. Although the word embryo could by common consent be used in the proposed sense of cyema, long usage probably would make such an attempt futile for this reason alone. The introduction of this term and of the others suggested does not needlessly change old usage. It abrogates nothing save confusion.

Since I recently happened upon the term cubus, which the ancient Greeks (Athenæus) used for what I have designated as the preiliac fossa[3] in bovines, sheep, goats and horses, I take pleasure in recording this incidental finding. At the time I suggested the above term nothing but the German designation "Hungergrube" was known to me. None of the works on veterinary medicine and anatomy in English, which were accessible to me gave a name for this fossa. Since the term cubus seems rather far fetched, at least to one unfamiliar with its origin, I can not recommend the term cubical fossa.

At the suggestion of the late Professor Mall, who was ever ready to welcome and accept whatever answered a need, I am prompted also in this connection to say a few words in explanation and justification for several titles I have used in scientific papers. One of these titles is the old one of Spolia Anatomica.[4] Some of my friends have taken exception to this title and others have felt prompted to twit me! The objection apparently is to the word *spolia*. I used it in an inclusive sense to represent observations and descriptions of anomalies from the dissecting room and such as I happened upon while engaged in investigation. All of the things reported under this head were essentially anatomic windfalls. Since they were incidental to the work of the student of anatomy and the dissecting room, or that of the anatomist in his laboratory, they certainly could with entire propriety be called by-products or leftovers—spolia. That is exactly what they were. This use is an old and not a new one. In fact, such use is not new even in modern literature of anatomy. If I am informed rightly, the skin, horns and hoofs, and so forth, were regarded as the spolia or by-products of slaughtering, and this they remain to this day. Likewise, the shield and sword and armor of the fallen combatant were the spolia or the by-products of the gladiatorial combat. They too were removed in the spoliary or spoliarum. And even in the chase and, for that matter, in many wars of the *past* the spoils were the by-products, not the aim. To have interchanged the two is a very recent and lamentable thing. I am also reminded, and very gladly so, that there still are those to whom the spoils of angling and the chase remain incidental and the love of these sports, the aim.

While I must insist then that the use of the term spolia anatomica, is strictly correct, I can not commend it very highly. It tells no more about the content of a paper than the wastebasket does of its content, and it makes proper indexing difficult. Consequently, unless, as generously done by the "Index Medicus," all sub-titles of an article so designated are listed separately, no one knows what has been reported under such an omnibus title. Usually the things so reported really do not attract the attention of those who would be interested in them. Furthermore, in these days of counting titles in order to gage a man's productivity, one inclusive title makes a very poor showing in place of three or four scores of separate ones. Yet in spite of all these disadvantages, I chose the term advisedly and

[3] *Am. Jr. Anat.*, Vol. 21, 1917.

[4] *Jr. Anat. Physiol.*, Vol. 48, 1914; *Anat. Rec.*, Vol. 9, 1915, and Vol. 12, 1917.

do not propose to desert it merely because I used it in other than the predominating sense.

I have also been guilty of using the term osteology redivivus.[5] I did this with full knowledge of the fact that well recognized English writers had used it in similar connection in other than anatomic literature. George William Curtis used it thus in American literature. Nor did I stop here for I sought the advice and the approval of one of the foremost philologists in this country, a man of international standing for several decades, who after looking the matter up said I would be following good precedent in using it.

I have used these terms then and am suggesting others now, not because I desire to appear versed in Latin and Greek, but because they express what I want to say, and fill a need. They are free as the mountain breezes and at the service of anyone who, like myself, knows none better. May those who do, make me and the science of embryology their debtors.

A. W. MEYER

STANFORD UNIVERSITY

THE ROOSEVELT WILD-LIFE FOREST EXPERIMENT STATION

NEVER before in America, and for that matter, possibly, never before in the world, has there been a forest biological station devoted primarily or exclusively to the study of every phase of forest wild life. The establishment of such a station at The New York State College of Forestry, at Syracuse University, is thus an event of considerable general interest and importance, not only to those interested in the conservation of wild life, to foresters, and to zoologists in general, and particularly to field naturalists, but in addition to many others who are interested in the ecology of fish, birds, game, fur-bearing animals, and other kinds of forest wild life. This station, named in honor of the man, a native of the state of New York, who, with Gifford Pinchot, did more for forestry and forest wild life than any one else has done, thus becomes a very appropriate memorial to Theodore Roosevelt. Further, this station is the direct outcome of plans, started in December, 1916, with the cooperation and hearty support of Theodore Roosevelt, for the investigation of forest animals.

The establishment of the present station, as a memorial to his father, has had the hearty support of Lieutenant-Colonel Theodore Roosevelt, Jr., who writes:

> I think your ideas are excellent and I know that my father would appreciate no type of memorial more than that which you suggest, as you know it was one of the subjects that was always uppermost in his mind. I give my consent without reservation for the use of his name for this memorial.

As suggested above this idea of a Roosevelt Wild Life Memorial is the only one of the suggested memorials, known to me, which comes so near the *direct approval* of Theodore Roosevelt. Plans for the study of forest wild life, as stated above, were presented to him in December, 1916, and received his characteristic approval with enthusiasm and energy. He suggested that they be taken up "in a big way," commensurate with their importance, and in these words we know the kind of memorial which is worthy of the man.

In New York state the forest land and fresh water area nearly equals that of the tilled land, so that the proper care, management, and use of forest wild life is one of the large economic and social problems, and it is this same wild life which is one of the two main sources of income which finances conservation in New York state. Thus on economic grounds alone New York state would be fully justified in establishing such a station. The character of the problems involved in the study of forest wild life in these millions of acres of forest lands and waters are similar in many respects to those involved in varied wild life preserves and sanctuaries, in our National Forests and in our National Parks. The function of this station, as defined by the New York law is:

> To establish and conduct an experimental station to be known as "Roosevelt Wild-Life Forest Experimental Station" in which there shall be maintained records of the results of the experi-

[5] *Anat. Rec.*, Vol. 8, 1914.

ments and investigations made and research work accomplished; also a library of works, publications, papers and data having to do with wild life together with means for practical illustration and demonstration, which library shall, at all seasonable hours, be open to the public.

Furthermore, the duties of the station are to make "investigations, experiments and research in relation to the habits, life histories, methods of propagation and management of fish, birds, game and food and fur-bearing animals and forest wild life."

This is a very comprehensive program and it opens up an immense field for investigation, for demonstration, and for the training of forest and park naturalists. Not the least important feature of the plan is that it provides for an establishment which will supplement the other equipment of the college in such a manner as to make unique facilities not only for research on wild life, but likewise for the training of students who wish to specialize in this kind of ecological study, either for the purposes of becoming technical forest naturalists and investigators, or as foresters interested in the development and practical management of fish and game in forests, and as well for similar work in parks, particularly in the National Parks.

The law passed in the Legislature so late in the session that no special appropriation was made available, but the experiment station funds of the college are available to make a start at once. Quarters will be provided at the college and at the college experiment station at Syracuse.

Such a wild life repository library as is contemplated by the law, would be unique as no such special library has been assembled in America, and would be of much general value.

As examples of the kind of problems which need attention, the following may be cited: We need to know much more about the life histories and habits of all of our large game, fur-bearing, and predaceous forest animals. Such a knowledge is an essential basis for sane legislation, and the proper care and use of such animals. Even such a common forest animal as the porcupine is really but little known. There are numerous problems on the relation of birds to forests that require detailed study. This is equally true of the game birds. The problem of stocking lakes and streams with game fish involves a great number of zoological problems that have not been investigated intensively. There are also many unsolved problems in connection with the production of food from forest lands and waters, involving many kinds of wild and even domestic animals, which can be best studied at such a station.

It is expected that this memorial, while receiving support from the Legislature of New York, will draw support as well from those private citizens throughout the nation who are admirers of Roosevelt and his conservation policies, and who are also in sympathy with the study of game and other wild life, and who recognizing the need of such a station will enable it to extend its work beyond the borders of the state.

The establishment of this state memorial has been brought about by the friends of Mr. Roosevelt and those of the State College of Forestry, and from their very inception these plans have had the hearty support of the dean of the college, Dr. Hugh P. Baker.

Charles C. Adams,
Director
The Roosevelt Wild Life Forest Experiment Station of the New York State College of Forestry, at Syracuse University

GABRIEL MARCUS GREEN[1]

Gabriel Marcus Green was born in the city of New York, on October 19, 1891. He attended the public schools of that city, graduating from Public High School No. 4 in 1904 as valedictorian of his class. He then entered the high school department of the College of the City of New York and in 1911 graduated from the college at the head of his class. In 1909 he received the Belden

[1] Minute on the life and services of Dr. Green placed upon the records of the faculty of arts and sciences of Harvard University at the meeting of April 1, 1919.

Mathematical Prize; in 1909 and 1910, the Pell Medal for the highest rank in all subjects; and in 1910 and 1911, the Kenyon Prize for Distinction in Pure and Applied Mathematics. He pursued his graduate studies at Columbia University, where he took the degree of master of arts in 1912 and doctor of philosophy in 1913. His thesis was entitled "Projective Differential Geometry of Triple Systems of Surfaces," and was a remarkable achievement, for he had, unaided, made himself master of this new field of geometry by independent study and added to it an important contribution. He was a member of the Phi Beta Kappa and Sigma Xi societies.

Dr. Green returned to his college the following year as instructor in mathematics. In 1914 he was appointed to an instructorship at Harvard, and in 1916 became a member of the faculty. Clear, interesting, vivacious, he imparted to his hearers an understanding of the subjects treated which served as a firm foundation for future study. In research he was exceedingly productive, and, brief as was the span accorded him for his scientific labors, he had by a notable series of memoirs contributed largely to the present development of his special field of projective differential geometry.

His appreciation of music was extraordinary. Although he had never had formal instruction, he had made himself a skilled pianist, and had sought expression in original compositon.

His disposition was genial. He was emotional and sensitive, and at the same time sympathetic and unselfish. For such a nature, the craving for the harmony of a homogeneous civilization with its uniform ethical ideals and the mutual understanding of its members must have been intense. Green found himself a member of two civilizations, and he was not spared the pain of incessant clashes of their ideals and habits of thought. But the fineness of his spirit and the nobleness of his character were such that, in the turmoil, he remained serene and grew in strength of mind and soul. High ambition and untiring energy, combined with great intellectual gifts, and a fine sense of duty toward his fellowmen, were the basis of his success.

An attack of influenza was followed by pneumonia, and he died at the Stillman Infirmary on January 24, 1919. The department lost in him a faithful fellow-worker and friend; the faculty, a teacher of unusual power, and a scientist of high achievement and higher promise.

WILLIAM F. OSGOOD,
LEO WIENER,
DUNHAM JACKSON,
Committee

SCIENTIFIC EVENTS

INTER-ALLIED COOPERATION IN CHEMISTRY[1]

PROFESSOR MOUREU presided over the recent conference in Paris, and among his French colleagues were Professors Haller, Béhal and Matignon, MM. Kestner, Poulenc, Marquis and Gérard. The British delegates were Professors Louis, Sir William Pope, Messrs. Chaston Chapman, W. F. Reid, E. Thompson and S. Maill. America was represented by Mr. Henry Wigglesworth, Lieutenant-Colonels Bartow, Norris and Zanetti, Dr. Cottrell and Major Keyes; Italy by Senator Paternò, Drs. Pomilio, Giordani and Parodi-Delfino; and Belgium by MM. Chavanne and Crismer.

It was unanimously decided to form an Inter-Allied Federal Council of not more than six representatives of each of the countries mentioned above, the members to hold office for three years, one third to retire annually and be eligible for reelection. The executive body is to consist of a president, a vice-president, and a general secretary. Mr. Jean Gérard will provisionally act as the secretary. In addition to the council a consultative committee will be formed, consisting of as many sections as may be necessary to secure the complete representation of pure and applied chemistry. The objects of the confederation are: To strengthen the bonds of esteem and friendship existing during the war between the Allied peoples; to organize permanent cooperation between the associations of the Allied nations; to coordinate their scientific and technical resources; and to contribute

[1] From *Nature*.

towards the progress of chemistry in the whole of its domain.

Neutral countries may be admitted later. The next meeting of the conference will be held in London on July 15–18, that being the date of the annual meeting of the Society of Chemical Industry.

So far as Britain is concerned, the choice of representatives and the supervision of the arrangements for the first meeting will be in the hands of the Federal Council for Pure and Applied Chemistry, of which Sir William Pope is president and Professor H. E. Armstrong the honorary secretary. Until the various nations concerned have chosen their representatives, little can be done, but Sir William Pope and Professor Louis are provisionally acting as the British representatives, and are in communication with their French colleagues.

The meeting in Paris was held under the auspices of the French chemical societies, especially the Société de Chemie Industrielle, the president of which, M. Paul Kestner, presided at some of the meetings.

THE BRITISH IMPERIAL ANTARCTIC EXPEDITION

Plans are being prepared for another Antarctic expedition, which will sail in the famous ship, *Terra Nova,* and be assisted by the latest improvements in aviation and wireless telegraphy. The organization is already in an advanced stage.

It will be known as the "British Imperial Antarctic Expedition," its leader being Mr. John L. Cope. Mr. Cope's name is well known in connection with expeditions to the Antarctic. He accompanied the Imperial Trans-Antarctic Expedition, 1914–17 as surgeon and biologist to the Ross Sea party, and was one of the party of nine who were left on the Great Ice Barrier to lay deposits after the Aurora had broken away from her moorings. Since returning to England Mr. Cope has served in the R.N.V.R. as a lieutenant, but he has never abandoned the idea of organizing a further venture at the earliest possible date.

Arrangements are so far advanced that the expedition will be able to leave England in June, 1920, and Mr. Cope states that the expedition will return in 1926. During the six years continuous communication is to be maintained with the centers of civilization by means of wireless equipment.

The main objects of the expedition will be:

1. To ascertain the position and extent of the mineralogical and other deposits of economic value known to exist in Antarctica, and arrange for their practical development as a further source of imperial wealth.

2. To obtain further evidence of the distribution and migration of the whales of economic value, and to create a British industry.

3. To investigate the meteorological and magnetic conditions of the Ross Sea area and at Cape Ann (Enderby Land) in connection with their influence on similar conditions in Australasia and South Africa, respectively. Such results have been proved of great value by the stations established by the Argentine government in the South Orkneys and by that established on Macquarie Island by the commonwealth of Australia, which has been given up owing to the war.

4. Generally to extend knowledge of Antarctica, especially with a view to obtaining further scientific data of economic importance.

Mr. Cope states that arrangements are being made to take an aeroplane to assist in surveying the interior of the continent. With this machine even a flight to the South Pole is contemplated.

The reason for calling the enterprise the "British Imperial Antarctic Expedition" is that the efforts of Mr. Cope and his comrades will be directed solely for the benefit of the British Empire. The temporary headquarters of the expedition are at 17, Somerset Street, W-1.

OUTLINE MAP OF THE UNITED STATES

The United States Coast and Geodetic Survey has completed a new outline map of the United States on the Lambert conformal conic projection, scale 1-5,000,000.

This map is intended merely as a base to which may be added any kind of special information desired. The shore line is compiled from the most recent Coast and Geodetic Survey charts. State names and boundaries, prin-

cipal rivers, capitals and the largest cities in the different states are also embodied.

The map is of special interest from the fact that it is based on the same system of projection as that employed by the armies of the allied forces in the military operations in France. To meet those requirements and at the request of the army, special publications were prepared by the Coast and Geodetic Survey.

Many methods of projection have been designed to solve the difficult problem of representing a spherical surface on a plane. As different projections have unquestionable merits as well as equally serious defects, the announcement states, any region to be mapped should be made the subject of special study and that system of projection adopted which will give the best results for the area under consideration.

The Mercator projection, almost universally used for nautical charts, is responsible for many false impressions of the relative size of the countries differing in latitude, according to the survey statement. The polyconic projection, widely used and well adapted for both topographic and hydrographic surveys, when used for the whole of the United States in one map has the serious defect of unduly exaggerating the areas on its eastern and western limits. Along the Pacific coast and in Maine the error in scale is as much as 6½ per cent., while at New York it reaches 4¼ per cent.

The value of the new outline map on the Lambert projection can best be realized when it is stated that it shows that throughout the largest and most important part of the United States, that is, between latitude 30½ degrees and 49 degrees, the maximum scale error is only one half of 1 per cent. This amount of scale error of one half of 1 per cent. is frequently less than the distortion due to the method of printing and to changes from the humidity of the air. Only in southernmost Florida and Texas does this projection attain its maximum error of 2 1-3 per cent.

The Lambert projection is well adapted to large areas of predominating east and west dimensions in the United States where the distance across from east to west is 14.5 times that of the distance north and south.

The strength of the Polyconic projection, on the other hand, is along its central meridian. The merits and defects of the two systems of projection may be stated in a general way as being at right angles to each other.

Special features of the Lambert projection that are not found in the Polyconic may be stated briefly as follows:

1. The Lambert projection is conformal—that is, all angles between intersecting lines or curves are preserved, and for any given point (or restricted locality) the ratio of the length of a linear element on the earth's surface to the length of the corresponding map element is constant for all azimuths or directions in which the element may be taken.

2. The meridians are straight lines, and the parallels are concentric circles.

3. It has two axes of strength instead of one, the standard parallels of the map of the United States being latitudes 33 degrees and 45 degrees, and upon these parallels the scale is absolutely true. The scale for any other part of the map, or for any parallel, can be obtained from special publication number 52, page 36, U. S. Coast and Geodetic Survey. By means of these tables the very small scale errors which exist in this projection can be entirely eliminated.

The map measures 25 inches by 39 inches and will be sold by the government at 25 cents.

THE LECONTE MEMORIAL LECTURE IN THE YOSEMITE, 1919

THE University of California through its university extension division will offer free to the public a course of scientific lectures in the Yosemite Valley during June and July, 1919. These are to be known as the LeConte Memorial Lectures in the Yosemite in honor of the name of Joseph LeConte, the famous naturalist and geologist who was for many years a member of the faculty of the University of California. The lecturers and topics for 1919 and the tentative dates are as follows:

I. Professor W. L. Jepson, department of botany, University of California.

1. The Origin and Distribution of But-

tercups in Yosemite, Tuesday, June 24.
2. The Biology of the Chaparral, Thursday, June 26.
3. The Ancestry of the Yosemite Pines and Sequoias, Friday, June 27.

II. Professor Frederick William Bade, lecturer, literary executor of John Muir.
1. John Muir, Nature and Yosemite, Tuesday, July 1.
2. Muir's View of the Valley's Origin Thursday, July 3.
3. Muir's Services to the Nation, Friday, July 4.

III. Dr. F. Emile Matthes, geologist, U. S. Geological Survey, Washington, D. C.
1. Origin of Yosemite Valley, as Indicated in the History of its Waterfalls, Tuesday, July 8.
2. The Highest Ice Flood in the Yosemite Valley (to be delivered at Glacier Point) Wednesday, July 9.
3. The Origin of the Granite Domes of Yosemite, Saturday, July 12.

IV. Professor A. L. Kroeber, department of anthropology, University of California.
1. Tribes of the Sierra, Friday, July 11.
2. Indians of Yosemite, Saturday, July 12.
3. Folk-lore of Yosemite, Sunday, July 13.

It is planned to give most of the lectures at the Village of Yosemite, probably in the pavilion or the open air. Certain of the lectures, especially those by Professor Jepson and Dr. Matthes, will be delivered at places in Yosemite which give concrete illustration of the scientific subjects under discussion.

SCIENTIFIC NOTES AND NEWS

Dr. Vito Volterra, professor of mathematical physics in the University of Rome, will deliver a series of six lectures on the Hitchcock Foundation at the University of California in August or September.

Dr. W. W. Campbell, director of Lick Observatory of the University of California, has been named head of an American delegation of astronomers that will attend the international meeting in Brussels in July.

Lieutenant Colonel John R. Murlin, Sanitary Corps, U. S. Army, who has been in charge of the Section of Food and Nutrition of the Surgeon-General's Office since September, 1917, has been discharged from the service to take up his work as the head of the department of vital economics at the University of Rochester. The work of the Section of Food and Nutrition is now under the charge of Major R. G. Hoskins, Sanitary Corps, U. S. Army.

Professor Anton Julius Carlson, chairman of the department of physiology at the University of Chicago, who as a major in the Sanitary Corps of the United States Army inspected American camps in England and is now a member of the American Relief Administration in France, will take the field again for the American Relief Administration, probably going up to Finland, and returning by Esthonia, Lettonia, Lithuania, Poland, Roumania and Vienna.

Dr. W. A. Cannon, of the department of botanical research of the Carnegie Institution of Washington, has just returned to this country from an absence of a year in central Australia. While abroad he studied the plants and plant conditions of the more arid portions of southern Australia, including the Lake Eyre Basin, a portion of the Flinders Ranges, and southwestern South Australia contiguous to the Nullarbor Plains.

Dr. C. H. T. Townsend sailed, early in April, for Brazil, where he has accepted a position as entomologist for the Brazilian government. Dr. Townsend has been with the Bureau of Entomology and has spent most of his time studying the Muscoid Diptera.

Mr. Frank C. Baker, curator of the museum of natural history of the University of Illinois, will spend a portion of the summer at Winnebago Lake, Wisconsin, conducting

molluscan studies in the interest of the Geological and Natural Survey of Wisconsin.

DR. J. H. GRISDALE, who has been for several years the director of the Experimental Farms Branch of the Dominion Department of Agriculture at Ottawa, has recently been appointed to the position of deputy minister of agriculture.

DR. SAMUEL C. PRESCOTT, of the Massachusetts Institute of Technology, formerly major in the Sanitary Corps, U. S. A., has been appointed expert in charge of dehydration investigations in the Bureau of Chemistry, Department of Agriculture, and will continue the investigations on this subject carried on during the war under the direction of the War Department.

C. M. WOODWORTH has resigned as instructor in genetics at the University of Wisconsin in order to take a position with the Bureau of Plant Industry, U. S. Department of Agriculture. He will devote his attention principally to a study of disease resistance in flax. The field experiments will be mostly in North Dakota, but Mr. Woodworth will retain Madison, Wis., as his permanent headquarters.

CAPTAIN S. T. DANA has resumed his duties with the Forest Service as assistant chief of forest investigations. During the war he was on the general staff as secretary of the army commodity committee on lumber, and in charge of determining wood requirements of the army.

W. FAITOUTE MUNN, formerly chemist in charge at the Baker and Adamson Works of The General Chemical Company, Easton, Pa., has accepted the position as chief chemist for The Brewster Film Corporation of East Orange, New Jersey.

PROFESSOR CHARLES E. FAY, of Tufts College, Massachusetts, president of the American Alpine Club, and Henry G. Bryant, of Philadelphia, have been elected honorary members of the French Alpine Club.

COLONEL E. LESTER JONES, superintendent of the U. S. Coast and Geodetic Survey, has been made by the king of Italy an officer of the Order of S. S. Maurizo e Lazzaro.

SIR ERNEST RUTHERFORD, recently elected Cavendish professor of experimental physics at the University of Cambridge, has been elected to a fellowship at Trinity College.

THE British Electrical Research Committee has appointed Mr. E. B. Wedmore as director of research.

THE British Institution of Civil Engineers has made the following awards for papers read and discussed at the meetings during the session 1918–19:—A Telford gold medal to George Hughes (Horwich), a Telford gold medal and an Indian premium to R. B. Joyner (Bombay), a Watt gold medal to W. S. Abell (London), a George Stephenson gold medal to the Hon. R. C. Parsons (London), a Webb prize to F. E. Gobey, (Horwich), Telford premiums to James Caldwell (London), H. B. Sayers (London), J. Reney Smith (Liverpool), and F. W. Scott (Benoni, Transvaal), and a Manby prize to E. L. Leeming (Manchester).

PROFESSOR R. KOBERT died on December 27, at sixty-four years of age. He was professor of pharmacology at Rostock.

THE death of Dr. Edmund Weiss, director of the Vienna Observatory for thirty-two years, which occurred in 1917, was recently announced by the Paris Academy of Sciences of which he was a correspondent.

THE death is announced of Dr. José Penna, professor of epidemic diseases at the University of Buenos Aires.

THE British Scientific Products Exhibition, arranged by the British Science Guild, will be open in the Central Hall, Westminster, from July 3 to August 5. Its objects are to illustrate recent progress in British science and invention, and to help the establishment and development of new British industries.

WE learn from *Nature* that at a recent meeting of the council of the Marine Biological Association of the United Kingdom it was announced that Dr. G. P. Bidder and Mr. E. T. Browne had each undertaken to contribute a sum of £500 towards a fund for the extension of the laboratory at Plymouth. The new building will be commenced at once, and the

scheme, when completed, will provide both a new and larger aquarium and special laboratories for physiological work.

A MESSAGE received from Rome states that in the province of Cattaniselta in the Island of Sicily, immense deposits of potash have been discovered and the preliminary investigations are said to establish these as the richest in the world. The exploitation of these deposits, if the first reports receive the confirmation hoped for, would make it quite unnecessary to have recourse to the German supplies.

MOSQUITOES representative of all species occurring at camps or posts where troops of the United States are stationed are to be collected for the Army Medical Museum in Washington. At present the collection is incomplete and medical officers have been directed to see that collections of these insects are made at the times and in the manner described in circular instructions being published. Collections of mosquitoes are to be made at each station at least biweekly, at three periods during the twenty-four hours, early morning from 5 to 6 A.M., midday, and after 7 P.M. The time of collection will vary in different latitudes, but observation will determine the time when the insects are most prevalent at each locality. They are to be collected by means of a suitable killer or by mosquito traps. The "chloroform tube" is the best and most easily obtained killer, and mosquito traps are also useful. Shipments of the mosquitoes in lots of 25 each in specially prepared boxes are to be mailed by medical officers at camps to the curator, Army Medical Museum, Washington, D. C.

IN announcing on March 20 the reopening of the Zoological Garden and the Aquarium, which had been closed by the military during the Berlin riots, the Berliner *Tageblatt,* as quoted in a press dispatch, notes the fact that because of the increased expense of operation the price of admission to the Zoological Garden will be advanced to 36 cents on week days and 24 cents on Sundays on April 1. In order to give the poorer inhabitants of the German capital a chance to enter the Garden there will be two "cheap Sundays" a month when the entrance fee will be only 12 cents, against the former figure of 7 cents. Since 1910 the Berlin City Council has been subsidizing the Garden at the rate of about $5,000 a year and the Aquarium with about $6,000.

THE Virginia deer is said to have been unknown in Nova Scotia until about 1888, and was afterwards introduced. However, bones of this animal have now been found in two widely separated prehistoric Indian shell-heaps in that province by archeologists of the Geological Survey, Canada. Toe bones have been found in a shell-heap near Mahone Bay on the outer coast by Mr. W. J. Wintemberg, in 1913, and a toe bone was also found in a shell-heap on Merigomish harbor on the north coast of Nova Scotia by Mr. Harlan I. Smith, in 1914. The identification of these bones has been confirmed by Dr. Gerrit S. Miller, of the United States National Museum. Other bones and teeth, supposedly of the same species, but not submitted to Dr. Miller, have also been found in these heaps.

UNIVERSITY AND EDUCATIONAL NEWS

THE General Education Board, founded by John D. Rockefeller, has made an appropriation of $500,000 toward a fund of two million dollars to be raised to endow a graduate school of education for Harvard University. The new fund will be named in honor of Dr. Charles W. Eliot, president emeritus of Harvard University.

DR. JAMES YOUNGER and his wife have given £30,000 to provide the University of St. Andrews with a memorial hall, to be used for university purposes.

THE sum of £10,000 has been given to the Cape University by the National Bank of South Africa.

DR. W. J. CROZIER has been appointed assistant professor in the department of zoology of the University of Chicago.

DR. E. W. LINDSTROM, who returned a short time ago from France, where he was in the aviation service, has been appointed assistant professor of genetics in the college of agriculture at the University of Wisconsin.

DR. BENJAMIN PALMER CALDWELL, formerly of Tulane University, New Orleans, and for the past three years professor of chemistry in Oglethorpe University, Atlanta, has accepted the professorship of analytical chemistry in the Polytechnic Institute of Brooklyn, and will begin his work there in the autumn.

AT the University of Saskatchewan, Assistant Professor L. L. Dines has been promoted to a full professorship of mathematics.

DR. ALEXANDER MCPHEDRAN has resigned the professorship of medicine in the University of Toronto medical department, and Dr. Duncan A. L. Graham has been appointed his successor. The *Journal* of the American Medical Association states that recently Sir William Osler invited professors of medicine in the United Kingdom to a dinner in Dr. Graham's honor, at which it was stated that Dr. Graham was the first whole-time professor of medicine appointed in the British empire. The appointment was made possible by the munificence of Sir John Eaton, Toronto. As a result all physicians in the service of the medical department at the university will resign, so that Dr. Graham will have a free hand in selecting his own staff.

DR. F. A. LINDEMANN has been appointed to succeed Professor Clinton in the chair of experimental philosophy at the University of Oxford.

DR. S. W. J. SMITH, F.R.S., assistant professor at the Imperial College, South Kensington, and for many years secretary of the Physical Society of London, has been elected to the Poynting chair of physics in the University of Birmingham.

DISCUSSION AND CORRESPONDENCE

THE CUMBERLAND FALLS METEORITE

ON April 9, last, a brilliant meteor was seen at mid-day to fall in a northwesterly direction across northeastern Tennessee. Though the sun was shining in this section, observers describe the light from the meteor as exceeding the sun in brightness. Passing over southeastern Kentucky, where the sky was obscured by clouds, the meteor made its presence known by violent detonations, accompanied by the spalling off of fragments. The first of these fell near Sawyer P. O., not far from the Falls-of-the-Cumberland.

The concussions produced by the bolide were terrific, causing buildings to rock, and producting the impression on some that the region was being visited by an earthquake. The first news of the phenomenon printed in the local papers so recorded it. Realizing that the detonations heard and shocks felt were due to the concussions produced by a falling meteorite the writer through the medium of these local papers, and by correspondence with postmasters and telegraph operators throughout the district affected has succeeded in determining the path of the meteor and has secured a number of the fragments. The main mass appears to be yet undiscovered. Falling in the most rugged and sparsely settled portion of southeastern Kentucky the prospects of this main mass being found are not promising.

The general azimuth of the meteor in its fall seems to have been about north 30 degrees west. Over Kentucky it paralleled roughly the line of the Cincinnati Southern Railroad. An interesting incident in this connection is the record of the progress of the meteor kept by the telegraph and telephone operators in the railroad stations and signal towers. They actually put it on a schedule something like an "extra," and heralded to operators ahead the arrival opposite them to the east of this mysterious visitor. The operator on another branch of the Southern Road at Coal Creek Tennessee saw the meteor disappear to the northwest at 12:21 P.M. The tower man at Tatesville, Ky., heard violent detonations to the east, and felt his tower rock at 12:27. Telephoning ahead to the Danville, Ky., operator, while yet talking to him he heard him reply at 12:30 "I hear it coming now." The distance from Tatesville to Danville in an air line is 48 miles. It took the meteor sounds, therefore, 3 minutes to travel this 48 miles. How much of this is due to the rate of sound traveling in air and how much to the north-

west component rate of the falling meteorite can not at present be stated. It seems now to be pretty well established that the meteor never crossed to the west side of the Cincinnati Southern Railroad.

For the forthcoming Bulletin of the Kentucky Geological Survey the writer has delineated upon a map of a portion of southeastern Kentucky the area in which all the fragments of the meteorite will probably be found. At present writing seven pieces ranging in weight from 13 oz. to 5¼ lbs. have been found that by their covering of glaze indicate that the split off from the main mass at a considerable distance from the ground. Fifty-two pieces weighing from less than an ounce up to four pounds have been found that are parts of a mass weighing originally about 31 pounds. This mass was broken into these numerous fragments as the result of falling on top of the conglomerate cliff which forms the walls of the gorge of the Cumberland River below the Falls.

The larger fragments, which split off from the main mass at a considerable height, besides the covering of glaze, have the characteristic pittings of meteorites. They are light gray in color, and exhibit a brecciated structure. A chemical examination of the material of which they are composed, made by Dr. Alfred Peter, of the Kentucky Agricultural Experiment Station, shows it to be mainly the mineral enstatite (silicate of magnesium). Through this is disseminated microscopic particles of nickel-iron and iron combined with sulphur in an amount not exceeding two tenths of one per cent. Small amounts of sodium and calcium are also present. The meteorite would therefore be classed as a chondritic aerolite. It has the same specific gravity as enstatite, 3.18.

Arthur M. Miller
Department of Geology,
University of Kentucky,
May 14, 1919

On the Auroral Display of May 2, 1919

The notes on this display, in Science, May 23, 1919, lead me to offer the following summary of my observations on it between 8:38 and 10:30 P.M. (75th meridian time), May 2.

There were streamers of increasing prominence from the time I first observed the display at 8:38, until the culmination at 8:50 to 8:55, when the sky from the north-northwest to north by west was covered from about 10 degrees to a height of 45 or 50 degrees with a deep crimson light. The auroral arch, which was unusually narrow and sharply defined below, and at times subdivided in two or three parts, continued with varying brightness and altitude (base about 8 to 15 degrees) till 10:30, at least. There was some moderate streamer display from time to time. The effect of the auroral display was heightened by the sweep of searchlight beams from the south, and by the presence of the relatively new moon in conjunction with Venus.

A very similar display was observed here February 27, 1919, from 8:50 till after 11 P.M., with crimson coloration in the north to an altitude of about 40° at 10:45 to 10:50.

Charles F. Brooks
Chevy Chase,
Washington, D. C.

Meeting of Plant Pathologists on Long Island to Discuss Potato Diseases

The summer potato inspection tour and conference arranged by the Advisory Board, American Plant Pathologists, will be held on Long Island from June 24 to 27, 1919 for the special purpose of studying potato mosaic and leaf roll. The members of the party will meet at the Griffen House, Riverhead, Long Island, Tuesday evening, for dinner, after which there will be a meeting at the Court House.

The next day will be spent in a tour of inspection of test plots of potatoes on the north side from Riverhead to Orient Point. There will be an informal conference at Riverhead during the evening. On June 26, a trip will be made to the south side, the day being spent in the inspection of an experimental test plot at Wainscott, and in conferences at Southampton. The party will then take an evening train to Garden City, Nassau County. The following day, June 27, will be spent in the

inspection of experimental plots at Glen Head and in visiting a few of the large truck farms for which Nassau County is famous. An evening meeting will be held at New York City.

The experimental test plots consist of plantings of healthy, mosaic, and leaf roll seed tubers obtained from northern and central New York, Vermont, Maine, Long Island, Prince Edward Isle, and Bermuda. Records of the behavior during 1918 of the parent plants will be compared with the behavior this year of the progeny. Much of this seed has been planted under the direction of pathologists who have been investigating these diseases. An opportunity will also be afforded to compare fields planted with seed from the north and with Long Island grown seed; of fields planted with mature and with immature seed.

Noted potato pathologists from the United States, Canada and Bermuda will be present to explain the various tests, to point out the characteristic symptoms, and to discuss the results observed here as well as other experiments they have conducted. The bearing of these observations and studies on seed certification will be given consideration at the conferences held during the tour. Invitations have been extended to a pathologist of England, of Ireland and of Holland, and some assurance has been received that one or more of these men will be present. It is expected by means of these observations and discussions that considerable light will be thrown upon the nature and behavior of these serious and baffling diseases and that thereby measures for control will be better understood.

Every pathologist interested in potatoes or in these particular types of diseases should plan, if possible, to attend, for the occasion is unusual in material available for study and in instruction presented. Horticulturists, agronomists and other persons interested are invited to join the pathologists.

Persons planning to attend should at once inform the writer in order that accommodations may be reserved for them. The farmers of Long Island have generously offered to provide the means of transporting the party about the island.

M. F. BARRUS,
Chairman, Committee of Arrangements

SCIENTIFIC BOOKS

Appendages of Trilobites. By CHARLES D. WALCOTT, Smithsonian Misc., Coll., Vol. 67, No. 4, Cambrian Geol. and Pal., IV., December, 1918, pp. 115–216 + index, Pls. 14–42, Text Figs. 1–3.

IN this recent paper Dr. Charles D. Walcott summarizes his investigations of the appendages of trilobites during the past forty-five years, a research undertaken in pursuance of a promise made to Professor Louis Agassiz in 1873. Since that time, he writes, "I have examined and studied all the trilobites that were available for evidence bearing on their structure and organization."

His summary of 1881[2] is reviewed and corrected, together with later papers discussing his various discoveries in this subject.[3] The highly organized trilobite, *Neolenus serratus* (Rominger), from the Burgess shale quarry opened by Dr. Walcott, near Field, B. C., several years ago, shows most graphically in the ten plates devoted to its illustration the highly specialized development of appendages, which is also figured in plates of the Ordovician trilobites, *Isotelus, Triarthrus, Calymene* and *Ceraurus*. In the figure of *Neolenus* the appendages include antennules, caudal rami, endopodites, epipodites, exopodites, exites and protopodites. The evidence of appendages is supplemented by numerous figured sections of *Ceraurus* and *Calymene*.

[2] The Trilobite: New and Old Evidence Relating to its Organization, *Bull. Mus. Comp. Zool.*, Cambridge, Mass., Vol. VIII., No. 10, 1881, pp. 191–224, Pls. I.–VI.

[3] *Proc. Biol. Soc. Washington*, Vol. IX., 1894, p. 94. *Smithsonian Misc. Coll.*, Vol. 57, 1912, pp. 164, 208, Pl. 24, Figs. 1, 1*a*. *Idem*, 1911, Pl. 6, Figs. 1, 2; 1912, Pl. 24, Figs. 1, 1*a*; Pl. 45, Figs. 1, 2, 3, 4. Text-book Pal. (Zittel), Eastman 2d ed., 1913, Vol. I., p. 701, Fig. 1,343, p. 716, Figs. 1,376, 1,377. *Smithsonian Misc. Coll.*, Vol. 57, 1912, pp. 149–153.

After discussing the mode of occurrence, conditions of preservation, manner of life including method of progression, food, defense and offense, the author describes species with appendages, which include besides the genera already mentioned, *Kootenia dawsoni* (Walcott), two species of *Ptychoparia* including a new one *P. permulta* from the Burgess shale quarry, *Odonotopleura trentonensis* (Hall), *Trinucleus concentricus* Eaton, and an unidentified Ordovician crustacean leg. The work of C. E. Beecher with *Triarthrus* is reviewed in some detail, and a different conclusion arrived at in certain features.

In section two of the paper the structure of the trilobite receives attention, the author again referring to Beecher and other writers including Jaekel, Beyrich, Barrande and de Volborth. He then discusses in detail the appendages, summarizing them as follows:

Cephalic: (1) Antennules, (2) antennæ, (3) mandibles, (4) maxillula, (5) maxilla.

Thoracic:

Abdominal:

Caudal rami:

Further comparisons are with the recent *Anaspides tasmaniæ* G. M. Thomson, a Malacostracan from Tasmania, *Koonunga cursor* Sayce, and *Paranaspides lacustris* Smith, also the parasitic crustacean *Cyamus scammoni* Dall, illustrations of all of which are given. After the extraordinary interest of the finely developed specimens in the plates representing *Neolenus,* attention will be drawn by those of *Isotelus, Triarthrus becki* Green, and other Ordovician trilobites, together with the sections of Cambrian and Ordovician trilobites, and finally the author's conclusions as expressed by several diagrammatic restorations, also sketches of thoracic limbs of trilobites and recent crustaceans, crustacean limbs, and six plates of tracks and trails of trilobites, each adding evidence to the author's deductions as to the appendages.

Some conclusions drawn are that the trilobite's appendages show him to have been a marine crustacean far more highly developed than would have seemed possible in a period so infinitely remote.

In its younger stages of growth a free moving and swimming animal, it later became a half-burrowing, crawling and sometimes swimming animal and moving at times with the flow of the tides and prevailing currents. Eggs have been found both within and free from the body. . . . It was at home on many kinds of sea-bottom and was able to accommodate itself to muddy as well as clear water.

It was intensely gregarious in some localities and widely scattered in others, depending upon local conditions, and habits of the various species.

Trilobites had an ample system of respiration by setiferous exopodites, epipodites, and exites attached to the cephalic, thoracic and abdominal limbs [as shown in restorations of the limbs on plates 34 and 35].

The structure of the gnathobases of the cephalic limbs indicates soft food such as worms, minute animal life and decomposed algæ. . . . The trilobite persisted from far back in pre-Cambrian time to the close of Carboniferous time . . . and left its remains more or less abundantly through about 75,000 feet of stratified rocks.

The paper is profusely illustrated and carefully indexed.

G. R. Brigham

SPECIAL ARTICLES

PRESOAKING AS A MEANS OF PREVENTING SEED INJURY DUE TO DISINFECTANTS AND OF INCREASING GERMICIDAL EFFICIENCY

In the course of investigations on the bacterial black-chaff disease of wheat, under the direction of Dr. Erwin F. Smith, a new method of seed treatment has been discovered which practically eliminates seed injury due to the use of disinfectants, and at the same time renders pathogens on the seed coats more susceptible to the action of the disinfectant. This is accomplished by allowing the seeds to absorb water for a definite period in advance of treatment. The saturation of the cells and cell-walls with water before treatment, by diluting the full-strength disinfectant beyond the point of injury as it enters the tissues, in accordance with the law of diffusion of dissolved substances, is the explanation of the results obtained. Not only is injury to germination prevented, but the germination of seeds thus treated is stimulated, reducing the danger of

seed infection by soil organisms during the sensitive period of germination.

On the other hand, experiments with wheat seeds infected with the black-chaff organism have shown that this method used with formalin will completely destroy the organism on the kernels. After screening and fanning to remove shrivelled grains, the treatment should be made by soaking infected seeds for ten minutes in water then draining and keeping moist for six hours. They are then soaked ten minutes in formalin 1:400 solution (1 lb. to 50 gallons of water) drained, and covered for six hours; then dried over-night and planted next day. If copper sulfate is used, the presoaked seeds are thoroughly wetted in the 1:80 solution (1 lb. to 10 gallons of water) for ten minutes, drained and kept moist twenty minutes, plunged for a moment into milk of lime, dried over-night and planted. The effect of the presoaking with water, besides preventing seed injury, is to stimulate dried and dormant bacteria on the seed coat, into vegetative activity, thereby rendering them more sensitive to the action of the disinfectant which must be applied at the end of the presoak period and of course before the seeds have begun to germinate. This is fully in accord with the established principle that microorganisms in a vegetative condition are more susceptible to destructive agents than when dry and in a resting stage.

The effect of the presoak method of seed treatment with chemical disinfectants is, therefore, two-fold—first, seed injury is prevented by the dilution of the disinfectant as it enters the presaturated seed tissues; second, the efficiency of the disinfectant on the pathogen is increased. In view of the fact that nine different varieties of wheat, also oats, barley and maize, have been treated by this method, using both formalin and copper sulfate, disinfectants of widely different chemical nature, in strong solutions (formalin 1:320 and copper sulfate 1:80) without appreciable injury to germination, it appears probable that the same physiological principles here utilized can be applied to other chemical disinfectants and to the treatment of other seed-transmitted diseases amenable to control by these disinfectants, with variations of course in the length of the presoak period (which is six hours for wheat, barley and oats, and ten to eighteen hours for maize) and of the subsequent disinfectant period, as found necessary for each kind of seed and pathogen.

The use of this method in farm practise involves no radical change in present procedure other than to keep seeds moist for definite periods before treatment. If the use of the presoak method is found efficient for the cereal smuts and other diseases as well as for the black-chaff disease of wheat, it will result in a saving of most of the seed now lost by present methods of treatment and also in increased germicidal efficiency. The formulation of this method, as here reported and later to be given in detail, opens up a wide field for the reinvestigation of practical seed treatment for the control of seed-transmitted diseases by chemical disinfectants.

HARRY BRAUN
LABORATORY OF PLANT PATHOLOGY,
BUREAU OF PLANT INDUSTRY,
U. S. DEPT. OF AGRICULTURE

THE AMERICAN PHILOSOPHICAL SOCIETY

THE annual general meeting of the society was held from April 24 to 26 and a program of over fifty papers covering a wide range of subjects was presented. The sessions were presided over by the president, Professor W. B. Scott and by vice-presidents G. E. Hale, H. L. Carson and A. A. Noyes.

Two important features were a symposium on the solar eclipse of June 8, 1918, and one on chemical warfare. In the former special attention was given to photographs and their interpretation of the prominences and the coronal arches and streamers obtained by members of the several expeditions sent from the Lick, the Mount Wilson, the Lowell, the Sproul and the Yerkes observatories.

PROGRAM

Thursday Afternoon, April 24, 2 o'clock

William B. Scott, D.Sc., LL.D., president, in the chair

The cosmic force, radio-action: MONROE B. SNYDER, director of the Philadelphia Observatory.

The conservation of the natural monuments (illustrated): JOHN M. CLARKE, director of depart-

ment of science and State Museum, Albany, New York.

Detection of ocean currents by their alkalinity (illustrated): Alfred G. Mayor, director of department of marine biology, Carnegie Institution of Washington, Princeton, N. J.

Ocean currents moving from warm into cold regions are relatively alkaline and their surface waters absorb CO_2 from the atmosphere so slowly that they remain more alkaline than one would expect from their temperature. Conversely cold currents moving into warmer regions retain their relative acidity and part with their CO_2 at so slow a rate that they become warmer than would be expected from their low alkalinity. In tropical regions of the Pacific the surface currents sometimes observed setting toward the eastward, against the prevailing westerly drift, are relatively acid and contain more CO_2 than we would expect from their temperature. The hydrogen-ion concentration of sea water can so easily be detected by using such indicator as thymolsulphonephthalein that the method may prove of service to navigation in detecting the presence of counter currents before the ship has been deflected from its course.

Some oceanographical results of the Canadian Arctic expedition 1913–18: Vilhjalmur Stefansson, commander of Canadian Arctic Expedition. (Introduced by Mr. Henry G. Bryant.)

Evolution and mystery in the discovery of America: Edwin Swift Balch, of Philadelphia.

Benjamin Franklin's art as applied to books for elementary teaching (illustrated): Charles R. Lanman, professor of Sanskrit, Harvard University.

The energy loss of young women during light household muscular activities (illustrated): Francis G. Benedict, director of Nutrition Laboratory (Boston) of Carnegie Institution of Washington, and Alice Johnson.

To supply exact information regarding the energy requirements for light household work, the Nutrition Laboratory has begun a study of the heat of women engaged in various domestic activities. The subjects thus far studied have been young women from the domestic science department of Simmons College, approximately 200 women taking part in the experiments. The apparatus used for determining the carbon-dioxide production was a large respiration chamber in which 25 or more individuals could be studied simultaneously. The chamber was well ventilated by forcing outdoor air in at one end and withdrawing the chamber air from the other. A certain proportion of the outcoming air was passed through purifiers which absorbed the carbon dioxide. By noting the gain in weight of these absorbers, a measure of the carbon dioxide given off by the young women could be obtained. The heat production or energy loss was then calculated from the carbon-dioxide production. In all, 12 experiments were made, covering 50 periods 20 or 25 minutes in length. To provide a standard for computing the increase in energy required for the particular household occupation studied, the energy loss of the groups of young women while sitting quietly reading two hours after a light breakfast was determined at the beginning of every experiment in from 1 to 3 periods. As a result of 23 rest periods on 12 experimental days, it was found that the average heat output per kilogram per hour was 1.12 calories. This average figure of 1.12 calories has a specific interest in that it indicates the probable heat production of women sitting quietly under ordinary living conditions with a moderate amount of food in the stomach.

The relative contribution of the staple commodities to the national food consumption: Raymond Pearl, professor of biometrics, school of hygiene and public health, Johns Hopkins University.

Hygiene and sanitation as improvised in the zone of operations during the Great War: Bailey K. Ashford, surgeon, U. S. Army. (Introduced by Dr. W. W. Keen.)

Bloodless removal of foreign bodies from the lungs through the mouth by bronchoscopy (illustrated): Chevalier Jackson, attending laryngologist, Jefferson Medical College, Philadelphia. (Introduced by Dr. W. W. Keen.)

Friday, April 25, 10 o'clock

William B. Scott, D.Sc., LL.D., president, in the chair

The new discoveries of extinct animals in the West Indies and their bearing on the geological history of the Antilles (illustrated): William D. Matthew, curator of American Museum of Natural History, New York.

During the last ten years, explorations in Porto Rico and Cuba have secured the fossil remains of various extinct animals from cave and spring deposits on the islands. Quite large collections have been obtained and it has been possible to reconstruct the entire skeleton of the largest animal found, a ground sloth about the size of a black

bear. Four kinds of ground sloths have been obtained in Cuba and one in Porto Rico; all are related to the large extinct North American ground sloth *Megalonyx*. There are also several kinds of rodents, all of them distantly related to South American groups, chinchillas, spiny rats and perhaps agoutis, and a very remarkable little insectivore which is in a family by itself, and is found both in Porto Rico and Cuba. A giant tortoise, very thin-shelled like the tortoises of other oceanic islands but in some respects very peculiar, a terrapin which still lives on the islands and is closely related to species of the southeastern United States, and a crocodile also still living and near to a Central American species, are the principal fossil reptiles. Although the collections are large, no trace of any kinds of hoofed animals or carnivora have been found, nor any other kinds of rodents save the above South American groups, or of edentates except the one family of ground sloths. The characters of the fauna are believed to prove that the islands have been isolated for a long time, at least since the early Pliocene, and have never had any direct connection with North America; and to indicate that they have probably never had any land connection with South or Central America. There is little question that during the Pliocene or Pleistocene the islands were elevated to or near the borders of their submarine shelves, enlarging and connecting them to some extent, and there is some evidence, but not conclusive, for union of the greater Antilles and as far east as the Anguilla bank.

Characters and restoration of the Sauropod genus Camarasaurus Cope, from the type-material in the Cope collection of the American Museum of Natural History: HENRY FAIRFIELD OSBORN, research professor of zoology, Columbia University, and CHARLES C. MOOK.

Energy conception of the cause of evolution: HENRY FAIRFIELD OSBORN.

The parasitic Aculeata, a study in evolution (illustrated): WILLIAM M. WHEELER, professor of economic entomology, Bussey Institution, Harvard University.

Two recent entomological problems—the pink bollworm and the European corn borer: L. O. HOWARD, chief of Bureau of Entomology, U. S. Dept. of Agriculture, Washington.

Hydration and growth: D. T. MACDOUGAL, director of the department of botanical research, Carnegie Institution of Washington, Tucson, Arizona.

Hydration of agar and agar-protein in propionic acid and its amino-compounds: D. T. MACDOUGAL, director of the Desert Laboratory, Tucson, Arizona, and H. A. SPOEHR.

Sterility and self-and-cross-incompatability in shepherd's purse (illustrated): GEORGE H. SHULL, professor of botany and genetics, Princeton University.

Sexual reproduction is a complex succession of processes, all of which must be coordinated with a considerable degree of perfection in order to be successful. The chain of events leading from the spore mother-cells (oogonia, spermatogonia) through successful fertilization to fully developed viable seeds, may be broken at any one of a number of different points, and may be affected by many agents, both environmental and hereditary. No one should expect, therefore, to be able to bring all cases of sterility under a common viewpoint. In the common shepherd's purse (*Bursa Bursa-pastoris*) there exists a great number of biotypes, each of which has its own characteristics with respect to sterility and fertility, as well as other features, both morphological and physiological. In most of the common forms growing in Europe and eastern North America the lower flowers of the main axis are nearly always entirely sterile. A species common throughout the Pacific coast region of North and South America, and extending at least as far eastward as Tucson, Arizona, has, on the other hand, no sterile flowers at the base of the central raceme. A form similar to the Pacific coast form has also been found in Holland. A cross between the Tucson plants and those from eastern America has given rise to partially sterile hybrids which are characterized by rhythmic succession of sterile and fertile flowers, and there is some evidence that this rhythmic arrangement is under the control of two genetic factors, so that the F_2 from such a cross consists of about one like either parent to fourteen which display again a rhythmic succession of sterile and fertile flowers.

The basis of sex inheritance in Sphærocarpos (illustrated): CHARLES E. ALLEN, professor of botany, University of Wisconsin. (Introduced by Professor Bradley M. Davis.)

Hydrogen-ion concentration of nutrient solutions in relation to the growth of seed plants: BENJAMIN M. DUGGAR, research professor of plant physiology, Missouri Botanical Garden, St. Louis. (Introduced by Professor Bradley M. Davis.)

The relation of the diet to pellagra (illustrated):

E. V. McCollum, professor of bio-chemistry, Johns Hopkins University. (Introduced by Dr. Henry H. Donaldson.)

Friday, April 25, 2 o'clock

George Ellery Hale, Ph.D., Sc.D., LL.D., vice-president, in the chair

The eclipse expedition from the Lick Observatory: some solar eclipse problems (illustrated): W. W. Campbell, director of the Lick Observatory, Mount Hamilton, Calif.

The expedition of the Mount Wilson Observatory to the solar eclipse of June 8, 1918 (illustrated): J. A. Anderson, Mount Wilson Solar Observatory, Pasadena, Calif. (Introduced by Professor John A. Miller.)

A description of the equipment used at Green River was given; the compact arrangement of the different units being the chief feature. Owing to clouds, the results were not what was hoped for. Good photographs of the corona were secured; the wave-length of the green coronal line was quite accurately determined; and certain data of value for future eclipse work were obtained.

The Lowell Observatory eclipse observations, June 8, 1918: prominences and coronal arches (illustrated): Carl O. Lampland, Lowell Observatory, Flagstaff, Arizona. (Introduced by Professor Eric Doolittle.)

The author deals with some of the more important results obtained by the expedition sent sent out by his institution, but especial attention is given to the prominences and the detail of the inner corona. Several conspicuous prominences were shown in the photographs and these are generally surrounded by complex coronal structure. These coronal arches or "hoods" are probably among the most conspicuous and remarkable photographed up to the present time. In the present observations there appears to be no doubt as to the intimate relation between the prominences and the surrounding coronal structure. From a comparison of the observations of earlier eclipses made at different epochs of solar activity it seems probable that complex coronal detail and disturbed regions of the corona around and in the neighborhood of the prominences are more pronounced near sun-spot maxima; that such detail is much less conspicuous and occurs more rarely at or near the minima of sun-spot activity.

The flash spectrum (illustrated): Samuel Alfred Mitchell, director, McCormick Observatory, University of Virginia. (Introduced by Professor John A. Miller.)

Electric photometry of the 1918 eclipse (illustrated): Jacob Kunz and Joel Stebbins, University of Illinois, Urbana, Ill. (Introduced by Professor John A. Miller.)

The Sproul Observatory eclipse expedition: The form of the coronal streamers (illustrated): John A. Miller, director of the Sproul Observatory, Swarthmore College, Pa.

Results of observations of the eclipse by the expedition from the Yerkes Observatory: Edwin B. Frost, professor of astrophysics and director of Yerkes Observatory, University of Chicago.

Self-luminous night haze (illustrated): E. E. Barnard, professor of practical astronomy, University of Chicago.

The author dealt with a little-known feature of the night skies. It is a faintly luminous haze that is sometimes visible on otherwise clear nights when the moon is absent. It does not seem to be connected with any known auroral phenomenon. It seems not to be some form of cirrus or cirrostratus cloud that for some reason, on rare occasions, is more or less faintly self luminous at night. The source of its light is unknown. When best seen it is quite noticeable as a streaky luminous haze; sometimes it appears in broad sheets. It drifts easterly over the stars and remains visible with a faint steady light for a considerable length of time. Sometimes it seems to be absent for several years. At other times there is a great deal of it. It is seen in all parts of the sky, differing thus from the ordinary auroral phenomena, which are mostly confined to the northern part of the sky.

Photometric measurements of stars: Joel Stebbins, professor of astronomy, University of Illinois. (Introduced by Professor Henry Norris Russell.)

Star clusters and their contribution to knowledge of the universe: Harlow Shapley, Mt. Wilson Solar Observatory, Pasadena, Calif. (Introduced by Professor George E. Hale.)

Tatar material in old Russian: J. Dyneley Prince, professor of Slavonic languages, Columbia University.

Friday Evening, April 25

Reception from eight to eleven o'clock in the hall of the Historical Society of Pennsylvania,

southwest corner of Locust and Thirteenth Streets, at 8.30 o'clock.

Arthur Gordon Webster, Sc.D., LL.D., professor of physics, Clark University, Worcester, spoke on the "Recent applications of physics in warfare" (illustrated).

Saturday, April 26,

EXECUTIVE SESSION—9.30 O'CLOCK

Special business—Action upon the proposed amendments to the laws.

Stated business—Candidates for membership balloted for, with the result that the following new members were declared elected: Robert Grant Aitken, Sc.D., Mount Hamilton, Calif.; Joseph Charles Arthur, Sc.D., Lafayette, Ind.; Edward W. Berry, Baltimore; James Henry Breasted, A.M., Ph.D., Chicago; Ulric Dahlgren, M.S., Princeton; William Curtis Farabee, A.M., Ph.D., Philadelphia; John Huston Finley, LL.D., Albany, N. Y.; Stephen Alfred Forbes, Ph.D., LL.D., Urbana, Ill.; Chevalier Jackson, M.D., Philadelphia; Dayton C. Miller, A.M., D.Sc., Cleveland; George D. Rosengarten, Ph.D., Philadelphia; Albert Sauveur, S.B., Cambridge, Mass.; William Albert Setchell, A.M., Ph.D., Berkeley, Calif.; Julius O. Stieglitz, Ph.D., D.Sc., Chicago; Ambrose Swasey, Sc.D., D.E., Cleveland.

10 O'CLOCK

Hampton L. Carson, M.A., LL.D., vice-president, in the chair

Artificial formations resembling lunar craters: CAPTAIN HERBERT E. IVES, of Philadelphia.

The meteorological service of the Signal Corps in the war: ROBERT A. MILLIKAN, professor of physics, University of Chicago.

Detection of submarines (illustrated): HARVEY CORNELIUS HAYES, Naval Experiment Station, New London. (Introduced by Professor John A. Miller.)

This paper discussed various possible methods. The most effective one resulted from the development of a system of multiple sound sensitive receivers mounted in such a way as to transmit to both ears of the observer a cumulative or summational impulse which becomes a maximum when the instrument is properly directed, thus showing the direction of the submarine. It is clear that such an instrument would be valuable in peace times also in indicating the presence and direction of vessels in a fog.

Errors induced in bullets by defects in their manufacture: ERNEST W. BROWN, professor of mathematics, Yale University.

Sound and flash ranging: AUGUSTUS TROWBRIDGE, professor of physics, Princeton University, and late Lieutenant Colonel Engineers, of General Pershing's staff and in technical charge of the ranging service in the A. E. F.

The work of the Ballistic Institute of Clark University: A. G. WEBSTER, professor of physics, Clark University, Worcester, Mass.

Alternating-current planevector potentiometer measurements at telephonic frequencies (illustrated): A. E. KENNELLY, director, Research Division, Electrical Engineering Department, Massachusetts Institute of Technology, Cambridge, and EDY VELANDER.

The genesis of petroleum as shown by its nitrogen constituents: CHARLES F. MABERY, emeritus professor of chemistry, Case School of Applied Science, Cleveland.

Since so far as known complex nitrogen bases are produced in nature only through the agency of vegetable or animal life the universal presence of these bases in petroleum seems to be convincing evidence as to its origin. In most of the denser varieties these bases have been detected, in California and Russian petroleum in considerable amounts. In the present paper results are presented which show that the same or similar bases are generally present in the lighter varieties of the eastern fields—Pennsylvania, West Virginia and the Berea Grit of southern Ohio. I procured authentic specimens from these fields and find that they all contain from one part in 10,000 to one part in 20,000. A special method of analysis had to be devised to determine such minute proportions of nitrogen, a combination of the Dumas method for nitrogen and the oxygen method for carbon and hydrogen. Briefly described, the combustion was made in a glass tube one half filled with copper oxide, and in the vacant space the oil was placed in a boat with an oxidized copper roll behind and next behind a large boat containing potassium chlorate. In a second furnace was placed a steel tube filled with copper oxide, and heated to full redness to oxidize completely the hydrocarbons. Tight joins were made with castor oil seals and with a special form of rubber tube also luted with castor oil. Nitrogen was sufficiently removed by CO_2 from a rear generator containing several pounds sodium bicarbonate and repeated evacuations with a power pump extending through several days. The paper gives the results of analysis

in a table and in another table the history of the samples.

Graphic representations of functions of the nth degree: Francis E. Nipher, professor emeritus of physics, Washington University, St. Louis.

Glimpses of the near east during the war: A. V. W. Jackson, professor of Indo-Iranian languages, Columbia University.

The empire of Amurru: A. T. Clay, professor of Assyriology and Babylonian literature, Yale University.

The science of stealing (steyacastra) in ancient India: Maurice Bloomfield, professor of Sanskrit, Johns Hopkins University.

The crib of Christ: Paul Haupt, professor of Semitic languages, Johns Hopkins University.

The word translated "manger" in Luke II. 7, denotes one of the arched and open recesses in front of the travelers' chambers along the interior court of a caravansary. Shakespeare uses "crib" in the sense of "small chamber." The inn in which Jesus is said to have been born may be the hostelry mentioned in Jerem. XII. 17 where the Revised Version gives in the margin: the lodging-place of Chimham. The caravansary may have been founded by Chimham, the son of Barzillai, who followed David to Jerusalem (II. Sam. XIX. 38). The name Bethlehem is derived from this ancient inn near the town, on the road from Jerusalem to Hebron. Bethlehem does not mean House of Bread, but House of Bait, *i. e.*, halt for refreshment.

The atonement idea among the ancient Semites: Edward Chiera, instructor in Assyriology, University of Pennsylvania. (Introduced by Professor Morris Jastrow, Jr.)

Saturday, April 26, 2 o'clock

Arthur A. Noyes, Sc.D., LL.D., vice-president, in the chair

Symposium on Chemical Warfare—Historical introduction: Colonel Marston T. Bogert, Chemical Warfare Service, U. S. A.

The speaker gave a brief review of the history of chemical warfare both before and during the war, pointing out the high spots in the field and including also an outline of the organization of the Chemical Warfare Service of the United States Army and its activities.

Chemical warfare and research: Colonel George A. Burrell, Chemical Warfare Service, U. S. A. (Introduced by Colonel Bogert.)

Chemical warfare and manufacturing development: Colonel Frank M. Dorsey, Chemical Warfare Service, U. S. A. (Introduced by Mr. A. A. Blair.)

Production of chemical warfare munitions (illustrated): Colonel William H. Walker, Chemical Warfare Service, U. S. A. (Introduced by Professor H. F. Keller.)

Production of chemical warfare munitions (illustrated): Colonel Bradley Dewey, Chemical Warfare Service, U. S. A. (Introduced by Dr. Philip B. Hawk.)

This paper discussed the following points: (1) The problem of making over 5,600,000 gas masks in eight months; 5,000,000 of these going overseas together with 2,800,000 extra canisters. (2) The history of starting a government-owned factory at Long Island City, which on the day of the armistice covered a million square feet of floor space and had 12,500 employees. (3) The problem of manufacturing the chemicals for gas masks, with mention of the fact that 50 tons a day were necessary and with emphasis of the part played by the peach pit campaign in furnishing some of the 400 tons a day of coconut shells and peach pits necessary to produce the gas mask charcoal. (4) Mention of the manufacture of one half million horse masks and miscellaneous gas defense protective apparatus, other than horse masks. (5) A description with lantern slides showing some of the work done by the Field Testing Section, digging trenches and fighting miniature battles in gas in order to work out the characteristics of gas masks.

The usual banquet on Saturday evening was given at the Bellevue Stratford with about seventy-five members and guests present. Toasts were responded to by Honorable George Gray, Professor E. G. Conklin, Professor J. W. Bright and Dr. J. W. Holland.

Arthur W. Goodspeed

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